VII Semester Syllabi – Electronics & Communication Engineering

B.Tech. EC 2016 Batch Sem-VII [July-Dec2019]						
Sr. No.	Course Code	Course Name	L	T	P	Credits
1	EC3E*XX	Program Elective V	3	0	0	3
2	EC3E*XX	Program Elective VI	3	0	0	3
3	OEXXXXX	Open Elective III	3	0	0	3
4	EC3PC01	Project Work I	0	0	8	4
5	EC3PC03	Industrial Training	0	2	0	2
		Total	**11**	**0**	**8**	15
		Total Contact Hours	**19**			

Elective for 2016 Batch

Program Elective V

EC3EL05 Information Theory and Coding
EC3ET06 Metaheuristic Techniques
EC3EV05 VLSI for Wireless Communication

Program Elective VI

1. Communication Engg.- EC3EL06 Optical Networks
2. Computer Technology -EC3ET05 Introduction to Machine Learning
3. VLSI - EC3EV01 Design for Testability

Open Elective III

1. OE00058 IOT
2. OE00059 Cyber Security
3. OE00060 Robotics
4. OE00062 Imaging Systems for Industrial Applications
5. OE00061 Solar Energy and its Utilization

B.Tech. EI 2016 Batch Sem-VII [July-Dec2019]						
Sr. No.	Course Code	Course Name	L	T	P	Credits
1	EI3ELXX	Program Elective-V	3	0	0	3
2	EI3ELXX	Program Elective-VI	3	0	0	3
3	OEXXXXX	Open Elective-III	3	0	0	3
4	EI3PC01	Project Work I	0	0	8	4
5	EI3PC03	Industrial Training	0	2	0	2
		Total	**11**	**0**	**8**	**15**
		Total Contact Hours	**19**			

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EL05	Information Theory and Coding	3	0	0	3

UNIT I

Information measure of a source and symbol, average information or entropy of a source, rate of information, joint and conditional entropies, mutual information

UNIT II

Discrete memoryless channel, Channel Matrix, Types of channels: Lossless, Deterministic, Noiseless, BSC, Cascaded channels, Capacity of channel, Shannon-Hartley theorem of channel capacity, Shannon's limit, Capacities of special channels, Bandwidth-S/N trade-off

UNIT III

Source coding: Code Length, Code Efficiency, Source coding theorem, Classification of Codes: Uniquely decodable codes, Instantaneous codes, Prefix-free codes, Optimal Codes, Kraft's inequality,
Entropy Coding: Shannon-Fano Coding, Huffman coding

UNIT IV

Error Control Coding: Channel Coding, Channel Coding Theorem, Linear Block codes, Minimum distance consideration, Hamming Distance and weight, Generator Matrix, Parity check matrix, Syndrome Decoding, calculation of syndrome

UNIT V

Cyclic codes: Code Polynomial, Generator Polynomial, Parity-Check Polynomial, Syndrome Polynomial, Special cyclic codes, Convolutional codes: Impulse response of encoder, tree diagram, Trellis diagram, Decoding of Convolutional codes: Maximum likelihood decoding, Viterbi decoding algorithm

Text Books:

1. Simon Haykin, Communication Systems, John Wiley and Sons.
2. T. M. Cover and J. A. Thomas, Elements of Information Theory, Wiley-Interscience

Reference Books:

1. R. Gallagher, Information Theory and Reliable Communication, Wiley
2. R. Bose, Information Theory, Coding and Cryptography, Tata McGraw Hill Education Pvt. Ltd.
3. S. Gravano, Introduction to Error Control Codes, Oxford University Press, USA

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3ET06	Metaheurisetic Techniques	3	0	0	3

UNIT I Introduction

Optimization, Type of Optimization, combinatorial optimization, Optimization Algorithms, Metaheuristics, Exploration and Exploitation, Algorithm Complexity, No Free Lunch Theorems, Multiobjective and Multimodel optimization

UNIT II Genetic Algorithm :

Basic concepts, Search space, working principle. Encoding: binary, permutation, Value and Tree. Decoding, fitness function, Parent Selection : Roulette-wheel, Boltzmann, Tournament, Rank, Crossover : single-pint, two-point, multi-point, uniform, matrix and cross over rate, Mutation , mutation rate, Surviver selection: Delete all , Steady-state and Elitism. Adaptive GA and Real coded GA.

UNIT III Ant colony and BEE optimization

Ant foraging behavior, Ant Colony Optimization, Double Bridge Problem, Virtual Ant Algorithm

Behavior of Honey Bees, Honey Bee Algorithm, Virtual Bee Algorithm Artificial Bee Colony Optimization, traveling sales man problem, graph portioning.

UNIT IV Particle swarm Optimization

Basic principle, algorithm, flowchart. Variations of PSO: weighted, repulsive, stretched, comprehensive learning, combined effect PSO , clonal PSO, Accelerated PSO and multimodal PSO

UNIT V Bacterial Foraging Optimization

Forging theory, social foraging, foraging behavior of E. Coli bacteria, BFO algorithm, chemotatic, swarming, reproduction and elimination and dispersal. Variations of BFO: fuzzy BFO and Adaptive BFO

Applications: function optimization, adaptive system identification, channel equalization and financial forecasting.

Text Books:

1. Engineering Optimization: An Introduction with Metaheuristic Applications, Xin-She Yang, John Wiley
2. Evolutionary Computation: A Unified Approach De Jong PHI

Reference Books:

1. K. M. Passino, Biomimicry for optimization, control and automation
2. Search and Optimization by Metaheuristics Techniques and Algorithms Inspired by Nature **Du**, Ke-Lin, **Swamy**, M. N. S. , Birkhauser

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EV05	VLSI for Wireless Communication	3	0	0	3

UNIT I Communication Concepts in terms circuit designer perspective

Introduction, Access methods, Overview of Modulation schemes (BFSK,BPSK,QPSK), Wireless channel description, Path loss and its characteristics, characteristics of Multipath fading, Importance of Radiofrequency Design, RF Behavior of Passive Components, Review of MOS device physics, Nonideal effects in MOSFET.

UNIT II Receiver Architectures

Introduction, Receiver front end, Filter design, Rest of receiver front end, Nonlinearity, Harmonic distortion, intermodulation, IP_3, Gain compression, Noise, Noise Sources, Noise Figure.

Low Noise Amplifier (LNA): Introduction, Matching Networks, Matching for Noise and Stability, CMOS LNA.

UNIT III Mixers

Introduction, mixer fundamentals, Conversion Gain, unbalanced mixer, CMOS active Mixer, single balanced mixer, double balanced mixer: Gilbert Mixer, Passive CMOS Mixer.

UNIT IV Data Converters

Characteristics of S/H and Quantization noise, ADC and DAC specifications, ADC and DAC architectures, OP-AMP based ADC and DAC.

UNIT V

Frequency Synthesizer: Phase/Frequency-Processing Components Introduction, PLL based Frequency Synthesizer, Phase Detector/Charge Pump, Dividers, VCO, LCO, Ring Oscillator.

Text Books:

1. B. Leung VLSI for Wireless Communication, Prentice Hall - Electronics and VLSI Series
2. B. Razavi, RF Microelectronics, Pearson
3. T. H. Lee, The Design Of CMOS Radio-Frequency Integrated Circuits Cambridge University Press

Reference Books:

1. R. Ludwig, P. Bretchko, "RF Circuit Design" 1st Indian Reprint, Pearson Education Asia
2. B Razavi, "Design of Analog CMOS Integrated Circuits" McGraw Hill,

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EL06	Optical Networks	3	0	0	3

UNIT I

Fundamentals of communication Networks: Basics of optical communication and computer networking, services, switching, multiplexing schemes, telecom network overview and architecture, optical networks, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, Challenges of optical WDM network.

UNIT II

Optical network Components: Optical transmitters, semiconductor laser diode, tunable laser, photodectors, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, OADM, OXC, architecture, Couplers, isolators, circulators, optical line terminals, all optical cross connect configurations.

UNIT III

Optical network architecture: Synchronous optical network/ synchronous digital heirarchy-elements, multiplexing, layers, SONET physical layer, frame structure, WDM network architectures, QoS parameters for optical networks, wavelength routed networks, routing and wavelength assignment (RWA), optical multicast routing, access networks.

UNIT IV

Wavelength routing and Survivability: Classification of RWA algorithms, Problem formulation, routing sub-problem: fixed routing, fixed alternate routing, adaptive routing, fault tolerant routing, wavelength assignment sub-problem, wavelength reuse and conversion criterions, algorithms: flow deviation algorithm, fairness and admission control, restoration schemes, multiplexing schemes, provisioning restorable single fiber networks.

UNIT V

WDM Network Design: Cost Trade-Offs, LTD and RWA problems, wavelength conversion, Dimensioning Wavelength-Routing Networks, Statistical Dimensioning models, Maximum load Dimensioning models, Optimization algorithms and methods – routing algorithms, integer and mixed integer linear programming, heuristic optimization algorithms.

Text Books:

1. R. Ramaswami and K N Sivarajan, Optical networks – A practical prespective : Morgan Kaufmann Publishers
2. C. Siva Ram Murthy and M. Gurusamy, WDM optical Networks: Concepts, Design and algorithms , PHI

Reference Books:

1. B Mukherjee, Optical communication networks", Mc-Graw Hill, New York
2. U. Black, "Optical Networks –Third Generation Transport Systems"- Pearson Education.
3. S. Mukherjee, "Optical Networking in Telecommunication- Concepts, Technologies and Components". Jaico Publishing House.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3ET05	Introduction to Machine Learning	3	0	0	3

UNIT I

Introduction to Machine learning, Types of Learning, Hypothesis Space & Inductive Bias, Evaluation, Cross Validation, Linear regression with single and multiple variables, Logistic regression, regularization.

UNIT II

Neural Network: Biological neuron, structure of an artificial neuron, feed forward neural network, back propagation algorithm, single layer perceptron, multi-layer perceptron.

UNIT III

Classification: Generalized linear models, SVM, Non-linear hypothesis and Kernel Methods, Multi-class Classification, Model Representation, learning, unconstrained and constrained optimization.

UNIT IV

Unsupervised learning algorithms: Clustering, Dimensionality reduction, PCA, Anomaly detection, recommender systems.

UNIT V

Semi-supervised Learning, Reinforcement Learning: Deep Learning, CNN, RNN architectures, Training RNN- Loss and BPTT, LSTM, Deep RNN and Bi-RNN.

Text Books:

1. Introduction to Machine Learning by Ethem Alpaydin, the MIT Press
2. Introduction to Machine Learning by Alex Smola and S.V.N Vishwanathan Cambridge University Press Machine Learning by Tom Mitchell McGraw Hill

Reference Book:

1. T. Mitchell, Machine Learning, McGraw Hill

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EV01	Design for Testability	3	0	0	3

UNIT I

VLSI Testing needs and challenges, defects and faults, modelling of faults: stuck at faults, bridging faults, breaks and transistor stuck on/open faults, delay faults, temporary faults.

UNIT II

Fault diagnosis in digital circuits, test generation techniques for combinational circuits: one dimensional path sensitization, Boolean difference, D- algorithm, PODEM, FAN.

UNIT III

Testing of sequential circuits as iterative combinational circuits, state table verification, test generation based on circuit structure, functional fault models, test generation based on functional fault models

UNIT IV

Design for testability: Ad hoc techniques, scan path technique, level sensitive scan design, partial scan, boundary scan.

UNIT V

Built in self test (BIST): Test pattern generation for BIST, exhaustive testing, pseudo exhaustive and pseudo random pattern generator, output response analysis, BIST architecture.

Text Books :

1. N. Jha & S.D. Gupta, "Testing of Digital Systems", Cambridge.
2. W. W. Wen, "VLSI Test Principles and Architectures Design for Testability", Morgan Kaufmann Publishers.
3. P. K. Lala," Fault tolerant and fault testable hardware design", BS publication.

Reference Books:

1. M. L. Bushnell &V.D. Agrawal," Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwar Academic Publishers.
2. P. K. Lala," Digital circuit Testing and Testability", Academic Press.
3. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press,

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00060	Robotics	3	0	0	3

UNIT I Introduction to Robotics

Types and components of a robot, classification of robots, closed loop and open loop control system. Kinematics system; definitions of mechanism and manipulators, social issues and safety.

UNIT II Robot Kinematics and Dynamics

Kinematic modeling: translational and rotational representation, coordinate transformation, D-H parameters, Jacobian singularity and statics. Dynamic modeling: equation of motion: Euler Lagrange formulation

UNIT III Sensor and Vision System

Contact and proximity type, position, velocity, force, tactile etc. introduction to Cameras, Camera calibration, geometry of image formation, Euclidean/Similarity/Affine/projective transformations

UNIT IV Robot Control and Actuation System

Basics of control, transfer functions, industrial controllers such as P PI PID, nonlinear and advanced controls. Actuator, electric, pneumatic and hydraulic transmission gears, timing belts and bearings.

UNIT V Control Hardware and Interfacing

Embedded systems architecture and integration with sensors, actuators, components, programming for robot applications

Text Books:

1. S.K.Saha, "Introduction to Robotics", McGraw Hill Education, New Delhi
2. A. Ghosal, "Robotics", Oxford, New Delhi
3. R. K. Mittal and I. J. Nagrath, "Robotics and Control", TMH

Reference Books:

1. 1. J.J. Craig , "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi
2. 2. K. Fu, R. Gonzalez, and C.S.G. Lee, , "Robotics: Control, Sensing, Vision and Intelligence", McGraw- Hill.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00062	Imaging system for Industrial Applications	3	0	0	3

UNIT I Fundamental of Imaging Systems

Digital and analog Image formation and contrast sensitivity, Sampling and Quantization. Fundamental steps in image processing, Image acquisition, Imaging Geometry, Elements of basic Imaging system, Requirement of imaging system in various Industries, Important parameters of an imaging system design, Types of Imaging system used in Industries.

UNIT II Radiography

Basis of Radiology technique, Nature of X- ray, Production of X-rays, X-ray Machine, visualization of X-rays, Digital Radiography, condition monitoring using radiography, Limitations of radiography.

X-ray Computed Tomography:

Introduction of Computed Tomography, System Components, Gantry Geometry, Image reconstruction.

UNIT III Ultrasonic Imaging System

Instrumentation Design For Ultrasonic Imaging, Diagnostic Ultrasound, Physics of ultrasonic waves, Basic pulse– echo apparatus, A- scan, B-scanner, real time ultrasonic Imaging System, Multi- element linear array scanners, Through Transmission, Immersion Testing, Straight Beam and Angle beam testing.

UNIT IV

Thermal Imaging System

Thermography, Physics of thermography, Infrared Detectors, Thermo graphics Equipments, Types of thermography, Quantative thermography, ,Thermal Camera based on IR Sensor with digital focal plane array, Advantage of Thermal Imaging.

UNIT V

Other Imaging System

Imaging system in nanotechnology: scanning tunneling microscopy, and atomic force microscopy, scanning electron microscopy (SEM),transmission electronic microscopy (TEM).Nuclear Medicine: Gamma camera, SPECT and PET, Holography, Magnetic Resonance Imaging (MRI), Microwave imaging.

Text Books:

1. R.C. Gonzlez., and Paul, Wintz, "Digital Image Processing", Addison-Wesley Publishing Company.
2. Cartz, Louis. "Nondestructive testing."

Reference Books:

1. R.S. Khandpur, Handbook of biomedical instrumentation. Tata McGraw-Hill Education.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00061	Solar Energy and its Utilization	3	0	0	3

UNIT I

Solar Radiation

Nature of Solar Radiation, Global, Beam and Diffuse Radiation, Hourly, Daily and Seasonal variation of Solar Radiation, Radiation measurements and predictions

UNIT II

Solar Thermal Conversion

Solar thermal conversion: basics , Flat Plate Collector, Hot Air Collector, Evacuated Tube Collector, Parabolic , Compound Parabolic and Fresnel Solar Concentrators, Performance of Solar Collectors, Solar Water Heating Systems, Solar Industrial Process Heating Systems, Solar Thermal Power Systems.

UNIT III

Photovoltaic systems

Principle of photovoltaic conversion, Solar cells & panels, performance of solar cell, Organic solar cells, solar panels, Photovolatic systems, components of PV systems, performance of PV systems, design of PV systems, fabrication of photovoltaic devices

UNIT IV

Solar Photovoltaic energy conversion and utilization

Photovoltaic power generation systems, Off-grid and Grid connected power control and management systems Economics of solar photovoltaic systems

UNIT V

Economic analysis of Solar Energy Systems

Life cycle analysis of Solar Energy Systems, Time Value of Money, Evaluation of Carbon Credit of Solar Energy Systems,

Text Books:

1. D.Y. Goswami, F. Kreith & J.F. Kreider, Principles of Solar Engineering, Taylor & Francis
2. G.N. Tiwari, Solar Energy, Fundamentals design, Modelling and Applications. Narosa,

References Books :

1. J.A. Duffie, W.A. Beckman Solar Engineering of Thermal Processes , John Wiley
2. V. V. N Kishore, Renewable Energy Engineering and Technologies, TERI